DOCUMENT RESUME

ED 041 629 PS 003 286

AUTHOR Mickelsen, Olaf; And Others
TITLE The Prevalence of Anemia in Head Start Children. Nutrition Evaluation, 1968-69.
INSTITUTION Merrill Palmer Inst., Detroit, Mich.; Michigan State Univ., East Lansing. Head Start Evaluation and Research Center.
SPONS AGENCY Office of Economic Opportunity, Washington, D.C.
REPORT NO OEO-4118
PUB DATE 69
NOTE 22p.

EDRS PRICE EDRS Price MF-$0.25 HC-$1.20
DESCRIPTORS Body Height, Body Weight, *Cardiovascular System, *Disadvantaged Youth, *Health, Low Income Groups, *Nutrition, *Preschool Children, Racial Differences, Standards
IDENTIFIERS *Project Head Start

ABSTRACT

Concern over the nutritional status of the disadvantaged in America led to this study describing the prevalence of anemia among Head Start children in Pontiac, Michigan. Hemoglobin and hematocrit determinations, along with measurements of height and weight, were performed on 77 children, 4 to 6 years old, enrolled in Head Start classes. These measurements were taken twice, at the beginning and end of a 6-month interval. Due to attrition during the interval, only 52 of the children were available for the second session. When compared to the standards commonly used in nutritional surveys, only one child on both occasions had a hemoglobin level that would be considered anemic (i.e. below 11 gm/100 ml.). The mehatocrit standard of anemia, however (less than 33%), indicated that 5.3% of the children were anemic at the first reading and 7.8% at the second. Eighty percent of the subjects at both readings were black, and, although the differences were not statistically significant, these children had lower hemoglobin and hematocrit values than their white classmates. Applying two standards of height for age, the Stuart-Meredith percentile standards and the Iowa growth charts, it appears that the Head Start children measured were well within the acceptable ranges of "normal." (MH)

ED041629

Research and Evaluation Papers of the

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
OFFICE OF EDUCATION
THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL OFFICE OF EDUCATION POSITION OR POLICY

F-OEO
PS

Head Start Evaluation and Research Center

Nutrition
Evaluation
1968-69

MICHIGAN STATE UNIVERSITY
COLLEGE OF HOME ECONOMICS
in conjunction with the
MERRILL-PALMER INSTITUTE

THE PREVALENCE OF ANEMIA IN HEAD START CHILDREN

Olaf Mickelsen
Robert Boger
Laura Sims
Eileen Earhart

PS003286

Robert P. Boger, Center Director, Michigan State University
Irving E. Sigel, Director of Research, Merrill-Palmer Institute
Donald J. Melcer, Associate Director for Evaluation, Michigan State University
Patricia P. Olmsted, Associate Director for Research, Merrill-Palmer Institute

Supported by
OEO Contract 4118 with the
Office of Economic Opportunity

THE PREVALENCE OF ANEMIA IN HEAD START CHILDREN

Olaf Mickelsen, Ph.D., Laura Small Sims, M.P.H.

Department of Foods and Nutrition

Robert P. Boger, Ph.D. and Eileen Earhart, Ph.D.

Head Start Evaluation and Research Center

Michigan State University
East Lansing, Michigan 48823

Recent concern about the status of the disadvantaged in America has produced increasing reports of malnutrition among certain segments of the population. The social issue receiving most attention in Washington this year is the prevalence of hunger and malnutrition in the United States. Consequently, information on tne nutritional condition of the low income groups in our country has appeared in several Congressional Committee reports. Such reports are entitled, "Hunger Study" (Comm. on Agric., House of Representatives, June 11, 1968), "Hunger and Malnutrition in America" (Subcomm. on Employment, Manpower and Poverty, U.S. Senate, July 11-12, 1967), "Hunger and Malnutrition in the United States" (Ibid, May 23, 29, June 12, 14, 1968), and "Nutrition and Human Needs" (Select Comm. on Nutrition and Human Needs, U.S. Senate, Part I: Dec. 17, 18, 19, 1968; Part II: Jan. 8,9, 10, 1969; and Part III: Jan. 22, 23, 27, 28, 1969).

In 1968, a federally supported program entitled the "National Nutrition Survey" was initiated in ten states. These surveys will primarily assess the nutritional status of people in low income areas (1). One of these surveys (in Texas) has been completed and the preliminary report published (2). Other studies are currently being conducted on the premise that if nutritional deficiencies exist, the incidence will be greatest among the poor (3). Such surveys are necessary since precise data on the nutritional state of the lowest economic strata of our society are nonexistent. There are, however, a number of reports on the incidence of anemia. Current medical literature commonly describes anemia as a "significant public health problem among infants and young children" (4). In fact, some even regard this syndrome as the most common deficiency disease in infancy and childhood today (5).

Many accept the idea that nutritional anemia is particularly prevalent among "low income" or "disadvantaged" people. Klipstein states, "Anemia is more common among persons from a low socioeconomic setting and among non-whites than in the general population. . . . This is particularly true for children. . . . in whom the demand for iron is greater than normal" (6). Hillman and Smith suggest that low hemoglobin levels occur more frequently in the less favored economic groups. They attribute this to poor dietary patterns, resulting from ignorance and apathy, as well as to "marginal availability of essential nutrients" (7).

Project Head Start was initiated by Title 11-A of the Economic Opportunity Act of 1964, and was funded by the Office of Economic Opportunity as part of the Community Action Program. Designed as a means of social intervention to help children from culturally and educationally deprived families, the program contains five major components: health, nutrition, education, parent involvement, and social and psychological services (8).

During the first year of the Head Start program, mass screening of 7000 children, 3 to 6 years of age, failed to reveal the expected high incidence of anemia. The authors comment, "generalizations concerning the national incidence of nutritional anemia in preschool children on the basis of isolated local studies may not be warranted. . .however, regional studies may reveal local needs" (9).

A major objective of this paper is to present an analysis of data describing the prevalence of anemia among Head Start children in Pontiac, Michigan.

PROCEDURE:

Hemoglobin and hematocrit determinations were performed on 77 children, 4 to 6 years of age, enrolled in five classes of the Pontiac, Michigan*, Head Start Program. This sample accounts for approximately one-third of the children enrolled in the total program in that city. These five classes were participating in a curriculum intervention and evaluation project conducted by the Headstart Evaluation and Research Center at Michigan State University. Because each child met the criteria of eligibility for admission into the program he or she is assumed to be representative of the "disadvantaged" segment of the population.

One month after the program started, blood samples were collected from the 77 children enrolled; these are the "pre" data. A second series of blood samples was obtained from 52 of these children approximately six months later; they are the "post" data. Twenty-five children unaccounted for in the date either had dropped out of the program or blood samples were not collected from them for sundry reasons.

Finger prick blood samples were collected from each child for duplicate hemoglobin determinations and for duplicate microhematocrit determinations. Hemoglobin was determined by the cyanmethemoglobin procedure with a Fisher hemophotometer. On each occasion the hemoglobin procedure was standardized using a commercial standard, Hycel[1]. Microhematocrit determinations were performed using an International centrifuge. This procedure was repeated if the results were inconsistent with the hemoglobin values.

---

* According to the 1960 Census, the population of Pontiac, Michigan (25 miles north of Detroit) was 82,233. Incomes below $3000 anually were reported by 16% of the families; 45% of employed persons were engaged in manufacturing industries.

1 Purchased from Scientific Products, Allen Park, Michigan

Approximately one hour intervened between obtaining blood samples and final analyses.

Heights and weights were obtained for each child twice during the course of the program by a registered nurse assigned to the Head Start program. Body weights were recorded to the nearest 0.25 pound using a balance beam scale. Heights, determined by using a cross bar on the scale, were recorded in 0.25 inch increments. Both measurements were taken on the same days as blood samples were collected.

THE PROBLEM OF BLOOD STANDARDS:

A major problem in translating hemoglobin levels into clinical categories is the absence of an acceptable standard for identifying anemic individuals. Many "standards" have been proposed for describing normal blood values for individuals of various age groups. However, there is so much variation in these suggested values that the incidence of anemia as judged by one standard may be very different from that based on another.

The variation in standards can be shown only by comparing a few of the more commonly used criteria. One of the most widely used standards for nutrition surveys lists the following values for 3- to 12-year old children (10):

	Deficient	Low	Acceptable	High
Hemoglobin (gm/100ml)	10.0	10.0-10.9	11.0-12.4	12.5
Hematocrit (% PCY)[1]	30.0	30.0-33.9	34.0-36.9	37.0

[1] PCV = packed cell volume.

Only a few standards specifically set levels of hemoglobin indicative of anemia. This has been done by the American Medical Association which considers anemia to exist is the 6-month to 4-year-old group when the hemoglobin level is below 11 gm/100ml of blood or when the hematocrit level is below 33% (11). The Children's Bureau Publication, "Suggested Guidelines for Evaluation of the Nutritional Status of Preschool Children," proposes that Hb values of less than 10.0 gm/100ml and/or PCV less than 30% be considered indicative of anemia (12). Another Children's Bureau publication arbitrarily defines anemia in infants and preschool children as "a state in which the concentration of hemoglobin is less than 10 gm/100ml" (13).

One of the major differences encountered in the comparison of blood standards is the connotation imparted to the terms used. Values often designated as "normal" are misleading; the reader is uninformed as to whether this level is the most commonly occurring, the mathematical average, or that which is desired or optimal. Sources listing "normal" blood values usually give higher levels than those indicative of anemia.

One of the standard textbooks of pediatrics (Holt's, 14) gives "averages for optimal conditions" as:

Age	Hemoglobin (gm/100ml)	Hematocrit (% PCV)
3-4 years	13.2 $\pm$ 0.8	40 $\pm$ 3
4-5 years	13.4 $\pm$ 1.0	40 $\pm$ 2

Another widely used pediatrics text (Nelson, 15) lists the "normal" hemoglobin value for 4-year-old children as 13.1 gm/100ml. The "high" values for children from 3 months of age to adolescence, listed in the ICNND nutrition survey manual, are considered "normal" by one pediatrician (5).

PS 003286

Guest, et al, propose 12.5 gm/100ml as desirable for children between three months and adolescence (16). Smith considers the normal hemoglobin level for children to be between 12.5 and 13.5 gm/100ml (17).

Because of the wide variation in accepted standards, data for this study were recorded as absolute hemoglobin and hematocrit values. Table 1 presents the levels of hemoglobin and hematocrit values observed in the Pontiac Head Start Program with studies reported in the literature.

RESULTS:

When compared to the standards commonly used in nutritional surveys (11), only one child on both occasions had a hemoglobin value in the "low" category, i.e. below 11 gm/100ml. All others had "acceptable" or "high" hemoglobin values. The latter category had as its lower limit a hemoglobin level of 12.5 gm/100ml. Over 60% of the children had levels above that value. This was true for the determinations made early in the school year as well as those toward the end of the year.

Since nearly one-third of the children in the original group were unavailable for the second set of determinations, their original hemoglobin values were examined separately. On the 15 boys and 10 girls for whom there was only the first blood value, the average hemoglobin level was 12.6 gm/100ml with a range from 11.2 to 14.0 gm/100ml. This value is comparable to that obtained for the entire group, 12.5 ± 0.6 gm/100 ml (Table 2).

The Manual for Nutritional Surveys (10) suggests that children with hemoglobin levels below 11 gm/100ml may be considered anemic. On this basis, 1.3% of the "pre" and 1.9% of the "post" determinations were indicative of anemia. However, if a hematocrit value less than 33% is used as an indi-

Table 1

Incidence of Children with Low Hemoglobin and Hematocrit Values in the Pontiac, Michigan, Head Start Program with Selected Data from the Literature. (Mean hemoglobin and hematocrit values are also listed.)

	Hemoglobin gm/100 ml			Hematocrit % PCV				
	% < 10	% < 11	Mean ± S.D.	% < 30	% < 31	% ≤ 33	Mean ± S.D.	
Pontiac, Michigan "Head Start" Data:								
"Pre": n=77	0	1.3	12.5±0.6	0	0	5.3	36.75±2.0	
"Post": n=52	0	1.9	12.8±0.8	0	0	7.8	37.80±2.5	
Pearson, et al (9):								
Total N=7000								36.32±2.8
Chicago, n=3480					4.5			
Gainesville, n= 477					1.7			
Jacksonville, n= 622					2.8			
Augusta, n= 415					7.7			
Houston, n=1750					0.6			
Kravitz (25): n=2319	8.5	31.6						
Stine, et al (19):								
Total N= 768							Negro: 20 White: 5	35.97±3.32
All nonwhite, n= 578								35.64±3.39
All white, n= 190								36.96±2.39
All males, n= 371								35.75±3.25
All females, n= 397								36.17±3.18
White males, n=- 94								37.01±2.22
White females, n= 96								36.91±2.54
Nonwhite males, n= 277								35.32±3.43
Nonwhite females, n= 301								35.93±3.32
Kripke and VanFossen cited in Filer (4): n= 81		27.5						

Table 1 (Continued)

	Hemoglobin gm/100 ml			Hematocrit % PCV			
	% < 10	% < 11	Mean ± S.D.	% <30	% <31	% ≤33	Mean ± S.D.
Kerrey, et al (27):							
"low" income, n= 20			12.1 ± 2.9				38.9 ± 10.1
"high" income, n= 20			12.0 ± 2.8				38.8 ± 9.4
Owen, et al (3):							
Group A (lowest income)	24		10.6 ± 1.4				
Other groups	12		11.2 ± 1.2				
Haughton (31): n= 103	3.8						
Hutcheson (32): Total N=5126				4.3	11.8	25.9	
White, n=3968				4.1	9.2	23.6	
Nonwhite, n=1158				5.0	15.5	33.8	
Public Health Service Negro children under 7 years of age n= 169			11.3				
Goldsmith & Unglaub (18):							
Total N= 493	11.2	43.9	11.14 ± 1.1	1.0		5.4	37.2 ± 2.8
males n= 275			11.15 ± 1.1				37.2 ± 2.9
females n= 218			11.13 ± 1.1				37.2 ± 2.0
Unglaud (26): Total N= 499	11.2	40.8					

Table 2

Hemoglobin and Hematocrit Values for Pontiac, Michigan, Head Start Children

HEMOGLOBIN (gm/100 ml)	Deficient[1] < 10.0		Low 10.0 - 10.9		Acceptable 11.0 - 12.4		High ≥ 12.5		MEAN	RANGE
	No.	%	No.	%	No.	%	No.	%		
"Pre" Data: Boys	0	0	1[2]	2.2	16	34.8	29	63.0	12.5 ± 0.65[3]	10.1-14.0
Girls	0	0	0	0	12	38.7	19	61.3	12.5 ± 0.61	11.2-13.7
Total N= 77	0	0	1	1.3	28	36.3	48	62.4	12.5 ± 0.63	10.1-14.0
"Post" Data: Boys	0	0	1[2]	3.2	9	29.0	21	67.7[4]	12.9 ± 0.88	10.6-14.4
Girls	0	0	0	0	4	19.1	17	80.9	12.8 ± 0.68	11.0-14.1
Total N= 52	0	0	1	1.9	13	25.0	38	73.1	12.8 ± 0.78	10.6-14.4

HEMATOCRIT (PCV - %)	Deficient < 30.0		Low 30.0 - 33.9		Acceptable 34.0 - 36.9		High ≥ 37.0		MEAN	RANGE
	No.	%	No.	%	No.	%	No.	%		
"Pre" Data: Boys	0	0	2	4.0	21	46.7	22	49.3	36.7 ± 2.00	33-41
Girls	0	0	2	6.7	10	33.3	18	60.0	37.0 ± 2.00	32-40
Total[5] N= 75	0	0	4	5.3	31	41.3	40	53.3	36.8 ± 2.00	32-41
"Post" Data: Boys	0	0	2	6.4	6	19.4	23	74.2	38.0 ± 2.55	32-43
Girls	0	0	2	10.0	4	20.0	14	70.0	37.6 ± 2.54	32-41
Total N= 51	0	0	4	7.8	10	19.6	37	72.5	37.8 ± 2.54	32-43

[1] Standards: ICNND, Manual for Nutrition Surveys, 1963, p. 235 (10).
[2] Same Child
[3] Standard Deviation
[4] Rounding Error
[5] Hematocrit data were unavailable for several children for whom hemoglobin data had been collected.

cation of anemia, 5.3% of the children after the first determination, and 7.8% of the children after the second could be considered as anemic. That the hematocrit determinations indicated a greater prevalence of anemia than did the hemoglobin values was also reported by McGanity, who noted that in the Texas survey of nutritional status, the "percent of low values for hematocrit was several-fold greater than those for hemoglobin" (2). In contrast, Goldsmith and Unglaub, in comparing blood data with guidelines using the hemoglobin level, mean corpuscular hemoglobin, and hematocrit, state that "use of the hematocrit as the criterion of reference gives the lowest prevalence figures" (18). They further believe "hemoglobin values are probably of the greatest significance in determining the presence of clinically defineable anemia."

This discrepancy between values for both hemoglobin and hematocrit is more apparent at the lower end of the scale. In our sample of Head Start children, the boy with the lowest Hb value (10.1 gm/100ml) had a hematocrit value of 33%, while the girl with the lowest hematocrit value (32%) had a hemoglobin level of 11.2 gm/100ml. For the higher levels, the values for hemoglobin and hematocrit correlated more closely.

The 21 girls on whom both blood determinations were made showed an increase in hemoglobin level from an average of 12.5 for the first tests to 12.8 gm/100ml for the second. The corresponding hematocrit values were 37 and 37.6% respectively. The 31 boys, from whom blood samples were secured on both occasions, showed an average change in hemoglobin level from 12.5 in the fall to 12.9 gm/100ml in the spring. Hematocrit values were 36.7 and 28.0% respectively. For those children who showed changes in hemoglobin

values between the first and second determinations (Table 3), the maximum increase was from 11.5 to 13.6 gm/100ml, which correspond to an increase in hematocrit from 34% to 40%. The maximum decrease was from 13 to 12 gm/100ml hemoglobin, which likewise corresponded to a drop in hematocrit from 39% to 35%.

Table 3

Children Showing Changes in Hemoglobin Values between the First and Second Determinations

Hemoglobin Values	Boys		Girls		Total	
	No.	%	No.	%	No.	%
Increase 0.5 gm/100ml	12	38.7	9	42.9	21	40.4
Decrease 0.5 gm/100ml	5	16.1	2	9.5	7	13.5

Racial differences in blood values were noted (Table 4). On both occasions, approximately 80% of the children tested were Negro. Although the differences noted between the values for the Negro and white children are not statistically significant, the black children had lower hemoglobin and hematocrit values than the white. Stine, et al (9) indicated a similar occurrence in their study of preschool children in the District of Columbia. Owen has noted that "it would appear that iron deficiency is at least twice as prevalent among Negro as among white children." (20)

In 1949, a study conducted in Ferndale, Michigan (a northern suburb of Detroit, approximately 15 miles southeast of Pontiac) also indicated lower hemoglobin levels for Negroes as compared with white persons in similar age groups (21). While this racial difference seems to be consistently maintained, causal factors remain unexplained

Table 4

Racial Differences in Hemoglobin Values (gm/100ml)

	Negro		White*	
	Pre	Post	Pre	Post
Male	(n=37) 12.5 0.6	(n=25) 12.8 0.9	(n=9) 12.6 0.7	(n=6) 13.2 0.5
Female	(n=25) 12.4 0.6	(n=19) 12.8 0.7	(n=6) 12.8 0.4	(n=2) 13.0 0.6

* Includes 2 Mexican-American children

To more completely assess the health status of these children, blood data were compared to height changes. Height was chosen since it is influenced to a lesser extent by many extraneous factors than is weight. Our data were compared with two standards of height for age: the Stuart-Meredith percentile standards (22) and the Iowa growth charts (23). The stuart-Meredith tables give heights for age in percentiles. The Iowa growth charts provide a mean height-age curve and indicate standard deviations therefrom. Data for both of these standards were based on measurements of white children in Iowa: however, a recent publication indicated that measurements of Negro children in the District of Columbia were similar to those figures listed in the above standards (24).

Using the Stuart-Meredith percentile standards of height for age (17), Head Start children in Pontiac were well within the acceptable ranges of "normal" (Table 5).

Table 5

Hemoglobin Values in Relation to Mean Percentile Standards of Height for Age *

		Boys		Girls	
		No.	Mean Percentile	No.	Mean Percentile
"Pre" Data:					
Hemoglobin	13 gm/100ml	9	55	6	38
	11 gm/100ml	1 **	45	-	-
"Post" Data:					
Hemoglobin	13 gm/100ml	13	57	8	47
	11 gm/100ml	1 **	50	1	89

* Data tabulated using Stuart-Meredith percentile standards of height for age (22).

** Same Child.

When the heights of these children were compared with the Iowa height-age curves (23), all were again well within the range of normal. The initial date indicated that the 9 boys with high hemoglobin levels were 0.3% above the mean for height, while the 6 girls were 0.4% less than the mean. The one boy having a low hemoglobin level was 0.7% below the mean. The follow-up data showed that the 13 boys having hemoglobin levels greater than 13 gm/100ml were 1.4% above the mean of the Iowa growth standards of height for age, while the 8 girls with similarly high hemoglobin values were 2% below the mean height for age. One boy with a hemoglobin level less than 11 gm/100ml was 0.7% below the mean, while the girl with a hemoglobin level less than 11 gm/100ml was 4.1% above the mean height for age. These data suggest that this group of Head Start children compared favorably with accepted standards of growth.

Although no significant relationship existed between the children's

status on the growth curves and the blood data, a relationship is suggested between hemoglobin levels and incremental gains in height. The 13 boys with high Hb levels on both occasions increased 0.8 inches in height in the interim. The 8 girls with Hb levels above 13 gm/100ml increased in height by approximately 0.5 inches. However, the boy and girl having "low" hemoglobin values (less than or equal to 11 gm/100ml) did not gain in height.

DISCUSSION:

Recently many investigators have pointed to the prevalence of anemia especially among low income groups, as one index of the possible poor nutritional status of the general population. Since children reportedly have a high incidence of anemia, their condition has received the most attention. Studies have suggested a "generally high" incidence of anemia among Head Start children (20). In 1965, 8.1% of the children in the Chicago Head Start program were reported to have hemoglobin values below 10 gm/100ml, and more than 30% had hemoglobin levels below 11 gm/100ml (25). Pearson, et al, reported that the average hematocrit level for nearly 7000 Head Start children in Chicago, Gainesville, Houston, Augusts, and Jacksonville was 36.3%. These authors indicated that 1 to 8% of children four to six years of age were anemic on the basis of a hematocrit value below 31% (9).

The preliminary data from the Texas nutrition survey listed the mean hemoglobin level of children 5 years old as 15 gm/100ml for boys, and 13 gm/100ml for girls (2). Less than 4% of the 5-year-old group had levels below 10 gm/100ml.

Regional differences are apparent in the prevalence of anemia. Pearson, et al, indicated that the incidence of significant anemia showed considerable

variation from city to city (9). They found that children in Chicago and Augusta had an increased frequency of anemia, when compared with figures from Gainesville, Houston, and Jacksonville. In the New Orleans Head Start program in 1968, Goldsmith and Unglaub reported that 11.2% of the children had hemoglobin levels less than 10 gm/100ml (18). In 1969, Unglaub again reported that 11.2% of the children had hemoglobin values less than 10 gm/100ml, while 40.8% had levels less than 11 gm/100ml (26). These figures contrast with the relatively low numbers with similar hemoglobin values found in the Pontiac, Michigan Head Start program. Various factors, such as the iron content of the soil, methods of food preparation, or local dietary practices, might account for this noted geographic variability.

Hemoglobin values are commonly correlated with income data. In mississippi, Owen, et al, found that 24% of preschool children from the lowest socioeconomic group (annual per capita income less than $500) had hemoglobin values less than 10 gm/100ml, compared with a total of 12% of children from the higher income groups (3). The maan hemoglobin level for the lowest income group was 10.6 gm/100ml, and for the higher income groups 11.2 gm/100ml, a difference considered to be significant. Kerry et al (Table 1), in contrast to the previous studies, found no differences in hemoglobin levels between preschool children from low-income families when compared with children from higher income families (27).

The incidence of iron-deficiency anemia is reported to reach a peak in infants 12 to 17 months of age and decrease threrafter until the condition is overcome between 3 and 6 years of age (28). Owen stated that "the same trend of decreasing incidence of anemia with increasing age was noted in low income Mississippi children" (3). "By the age of 3½ years, anemia is

relatively rare, which suggests that because of the slow rate of growth in the preschool period, the child is able gradually to accumulate enough iron to meet his needs" (29).

In revising data for approximately 22,000 children between birth and 20 years of age registered in the Children and Youth Projects, values less than 10.0 gm/100ml were relatively frequent in children less than 3 years of age but much less frequent in older children (3). The percentage of children with hemoglobin levels below 10 gm/100ml were: 13.6% for infants to 6 months of age, 22.1% for infants 6 months to 1 year, 28.5% for children 1 to 2 years and 9.2% for children 2 to 3 years of age. Since hemoglobin levels seem to improve with age, it is possible that some of the Pontiac Head Start children may have had low hemoglobin levels at an earlier age.

The data presented from the Pontiac Head Start study are quite comparable to those from other studies throughout the country (Table 1). Whether one chooses to interpret the findings as suggestive of the extensive prevalence of anemia in these children will depend on the standard chosen. On the basis of hemoglobin and height, most of the Head Start children examined in Pontiac, Michigan appeared to be normal.

SUMMARY:

Hemoglobin and hematocrit values and the height meaaurements are presented for 77 children enrolled in the Pontiac, Michigan Head Start program. On the basis of these findings, the mean hemoglobin level of all subjects for blood collected in the fall shortly after the program started was 12.5 gm/100ml, while the mean value for blood collected in the following spring was 12.8 gm/100ml. Comparable hematocrit values were 36.8% and

37.8%, respectively. Over 60% of the children in this study were in the "high" range of values for both parameters according to standards commonly used in nutritional surveys (10). Comparisons of the blood data with nationally accepted growth standards of height for age revealed that these children were well within acceptable ranges of "normal".

ACKNOWLEDGEMENTS:

We wish to express our thanks to Dr. William R. Dito, Mr. William Bovian, Mrs. Arden Wilson, and the staff of the Pathology Department, Pontiac General Hospital, Pontiac, Michigan and to Mrs. Barbara Perkins, R.N., Head Start nurse, Pontian, Michigan, for their assistance in making this study possible. Mrs. Perkins generously gave of her time in effort in bringing in those children who were absent at the time of the initial examination so that complete data could be obtained.

REFERENCES CITED:

1. Schaefer, A. E. and Johnson, O. C.: Are we well fed? The search for the answer. Nutrition Today 4:3-11, Spring 1969.

2. McGanity, W. J.: Nutrition survey in Texas. Texas Medicine 65:40-49, March 1969.

3. Owen, G. M., Garry, P. J., Kram, K. M., Nelsen, C. E., Montalvo, J. M.: Natritional status of Mississippi preschool children: a pilot study. Am. J. Clin. Nutr. (In Press).

4. Filer, L. J.: The USA today--Is it free of public health nutrition problems? Anemia. Amer. J. Pub. Health 59:327-338, February 1969.

5. Jacobs, I.: Iron deficiency anemia in infancy and childhood. Gen. Prac. 21:93-97, 1960.

6. Klipstein, F. A.: Nutritional anemia among America's poor. Ann. Intern. Med. 68: 1125-1127, May 1968.

7. Hillman, R. W. and Smith, H. S.: Hemoglobin patterns in low-income families. Pub. Health Reports 83:61-67, 1968.

8. Head Start--A Community Action Program. Office of Economic Opportunity, Washington, D.C. 20506.

9. Pearson, H. A., Abrams, I., Fernbach, D. J., Gyland, S. P. and Hahn, D. A.: Anemia in preschool children in the United States of America. Pediat. Res. 1: 169-172, 1967.

10. Interdepartmental Committee on Nutrition for National Defense: Manual for Nutrition Surveys. (2nd Ed.) Bethesda, Md.: National Institutes of Health. 1963. p. 235.

11. Committee on Iron Deficiency: Iron deficiency in the United States. JAMA 203: 407-412, February 1968.

12. "Suggested Guidelines for Evaluation of Nutritional Status of Preschool Children", U.S. Dept of Health, Education, and Walfare, Children's Bureau, 1966, rev. 1967. p. 24.

REFERENCES (Continued)

13. "Prevention of Iron-deficiency Anemia in Infants and Children of Preschool Age." U. S. Department of Health, Education and Welfare, Children's Bureau, 1967.

14. Holt, L. E., McIntosh, R., and Barnett, H. L.: Pediatrics. (13th Ed.) New York: Appleton-Century-Crofts, Inc., 1962. pp. 592-593.

15. Nelson, W. E. (Ed.): Textbook of Pediatrics (8th Ed.) Philadelphia: W. B. Saunders Co,, 1964. p. 1007.

16. Guest, G. M., Brown, E. W., and Lahey, M. E.: Normal blood values in infancy and childhood. Pediat. Clin. N. Amer. 93: 362, May 1957.

17. Smith, C. H.: Blood Diseases of Infancy and Childhood. St. Louis: C. V. Mosby Co., (2nd Ed.), 1966. p. 204.

18. Goldsmith, G. A. and Unglaud, W. G.: Progress Report, Office of Economic Opportunity, Period July 1, 1968 - Sept. 30, 1968, Appendix III. (Unpublished).

19. Stine, O. C., Saratsiotis, J. B. and Furno, O. F.: Appraising the health of culturally deprived children. Amer. J. Clin. Nutr. 20: 1084, 1095, October 1967.

20. Select Comm. on Nutrition and Human Needs, U. S. Senate: Nutrition and Human Needs. Part II: USDA, HEW, and OEO officials. (Jan. 8, 9, 10, 1969). pp. 604; 585, 594-597.

21. Nutrition and Program Analysis Branches, Public Health Service: The Nutritional Status of Negroes. J. Negro Educ. 10:291, 1949.

22. Stuart, H. C. and Meredith, H. V.: Percentile standards. As published in: Watson, E. H. and Lowry, G. H.: Growth and Development of Children. Chicago: Yearbook Med. Publ. Inc., 1967 (5th Ed.). pp. 89-92.

REFERENCES (Continued)

23. Jackson, R. L. and Kelly, H. G.: Growth charts for use in pediatric practice. J. Pediat. 27:215-229, 1945.

24. Verghese, K. P., Scott, R. B., Teixeira, G. and Gerguson, A. D.: Physical Growth of North American Negro children. Pediatrics 44: 243-247, August 1969.

25. Kravitz, H.: Results of "Operation Head Start" in Chicago. III. Med. J. 129:590, 1965.

26. Select Comm. on Nutrition and Human Needs, U. S. Senate: Nutrition and Human Needs. Part III: The National Nutrition Survey. (Jan, 22, 23, 27 and 23, 1969). pp. 923-958.

27. Kerrey, E., Crispin, S., Fox, H. M. and Dies, C.: Nutritional Status of preschool children. I. Dietary and biochemical findings. American. J. Clin. Nutr. 21:1274, 1968.

28. Gutelius, M. F.: The problem of iron deficience anemia in preschool Negro children. Amer. J. Public Health 59:290-295, Feb. 1969.

29. Robertson, E. C.: The nutrition of children and adolescents, In: Beaton, G. H. and McHenry, E. W. (Eds.): Nutrition. A Comprehensive Treatise. Vol. III. New York: Academic Press, 1966, p. 72.

30. Proceedings of the Food and Nutrition Board National Academy of Sciences, National Research Council. 29:23, March 1969.

31. Houghton, J. G.: Nutritional anemia of infancy and childhood. Amer. J. Pub. Health, 53: 1121-1126, 1963.

32. Hutcheson, R. H.: Iron deficiency anemia in Tennessee among rural poor children. Pub. Health Reports 83: 939-943, Nov. 1968.